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ORIGINAL ARTICLE

Effect of neuraxial technique after inadvertent dural puncture on obstetric outcomes and anesthetic complications

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ABSTRACT

Background: The aim of this study was to evaluate labor and delivery outcomes in parturients with inadvertent dural puncture managed by either insertion of an intrathecal catheter or a resited epidural catheter.

Methods: This was a retrospective cohort review of 235 parturients who had an inadvertent dural puncture during epidural placement over a six-year period. The primary outcome was the proportion of women with a delayed second stage of labor. Secondary outcomes were the proportion of cesarean deliveries, the proportion of cases resulting in post-dural puncture headache, and the incidence of failed labor analgesia.

Results: Baseline characteristics such as age, body mass index and parity were similar between the two groups. Among the 236 cases of inadvertent dural puncture, 173 women (73%) had an intrathecal catheter placed while 63 women (27%) had the epidural catheter resited. Comparing intrathecal with epidural catheters, there was no observed difference in the proportion of cases of prolonged second stage of labor (13% vs. 16%, $P=0.57$) and the overall rate of cesarean deliveries (17% vs. 16%, $P=0.78$). However, we observed a lower rate of post-dural puncture headache in women who had cesarean delivery compared to vaginal delivery (53% vs. 74%, $P=0.007$). A greater proportion of failed labor analgesia was observed in the intrathecal catheter group (14% vs. 2%, $P=0.005$).

Conclusion: The choice of neuraxial technique following inadvertent dural puncture does not appear to alter the course of labor and delivery. Cesarean delivery decreased the incidence of post-dural puncture headache by 35%. Intrathecal catheters were associated with a higher rate of failed analgesia.

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Keywords: Dural puncture; Epidural analgesia; Intrathecal catheter; Cesarean delivery; Postdural puncture headache

Introduction

In developed countries, epidural analgesia is a popular mode of pain relief during labor. An important complication of the epidural technique is inadvertent dural puncture (IDP) with an associated post-dural puncture headache (PDPH). The risk of IDP during epidural placement varies between 0.5–1.5%,^{1–3} and the risk for developing PDPH is as high as 50%. Immediate management following an IDP is primarily driven by a combination of factors. First is the desire to avoid additional

procedures and minimize the incidence of PDPH while being observant of patient safety. Second is the preference of the anesthesiologist to either resite the epidural catheter at a different vertebral interspace, or insert an epidural catheter through the dural hole created by the IDP (i.e. an intrathecal catheter). Evidence for the best method of management remains inconclusive because of the logistic and ethical difficulty in conducting randomized double-blind trials, as well as the lack of good quality observational studies showing a clear benefit of one technique over the other. As a consequence, therapeutic decisions for the management of IDP are made according to the preference of the individual clinician, with practice surveys of obstetric anesthesiologists in the USA, the UK, and Australia indicating considerable heterogeneity.^{4–7}

Despite numerous studies, it is unknown if the choice of neuraxial technique after IDP alters either the course

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of labor or the mode of delivery. In the absence of an IDP, there is some evidence to suggest that the choice of technique might influence labor. For example, combined spinal–epidural technique (CSE) has been reported to be associated with more rapid cervical dilation in nulliparous women compared with epidural analgesia.⁸ In addition, early (<4 cm cervical dilation) initiation of intrathecal analgesia with fentanyl as part of a CSE technique has been found to be associated with a shorter duration of first stage of labor.⁹ However, there are important qualitative differences between CSE and intrathecal catheter analgesia. For example, local anesthetics are routinely administered as a continuous infusion following insertion of an intrathecal catheter for analgesia following IDP, as opposed to the use of a patient-controlled technique for epidural analgesia during CSE. Whether inclusion or omission of local anesthetics in the intrathecal infusion prolongs labor or is associated with more cesarean deliveries is still unknown.

To partially address this knowledge gap, we sought to study labor outcomes in parturients managed either with an intrathecal or a resited epidural catheter following an IDP. Furthermore, we sought to determine the incidence of PDPH and the need for an epidural blood patch (EBP) in the two groups using established criteria, and reconcile our findings with recent studies. We hypothesized that insertion of an intrathecal catheter would result in a lower incidence of prolonged second stage of labor with no change in the incidence of cesarean delivery.

Methods

After Institutional Review Board (IRB) approval (Partners IRB Protocol #: 2012P002256), we collected and analyzed data on term parturients (gestational age 37–42 weeks) with documented IDP at the time of initiation of epidural analgesia for labor and delivery between January 2006 and December 2012. We included IDPs that were either recognized at the time of needle placement, after catheter insertion, or after administration of the test dose. Patients meeting these criteria were retrospectively identified from our postpartum database of complications following obstetric analgesia and anesthesia, and their medical records were reviewed. Data pertaining to complications were contemporaneously entered into the database at the time of the event. We excluded patients where the diagnosis or documentation of IDP was unclear. We collected data on age, body mass index (BMI), parity, gestational age, use of long acting neuraxial opioids, duration of the second stage of labor, mode of delivery, and rate of catheter replacement for inadequate analgesia. In addition, we collected data on the incidence of PDPH and need for EBP in women who failed conservative management.

Post-dural puncture headache was defined as a generalized or frontal headache with a postural component, with or without tinnitus, photophobia and nuchal rigidity. Conservative management in our institution is hydration, bed rest and a trial of Fioricet (acetaminophen 650 mg, butalbital 50 mg, caffeine 40 mg) for at least 24 h. If these measures were ineffective, an EBP was typically performed within 2–3 days of onset of PDPH.

At our institution, we use the Arrow Epidural Catheterization Kit (Arrow International Inc., Reading, PA, USA), which has a 17-gauge Weiss needle with metal wings, and a 19-gauge FlexTip Plus[®] Catheter for establishing epidural analgesia. In the event of an IDP, our institutional practice is to insert the epidural catheter into the intrathecal space (intrathecal catheter) for all patients. However, if an intrathecal catheter could not be placed due either to paresthesia or difficulty with insertion, an epidural catheter was resited at a different interspace. Intrathecal analgesia was initiated with bupivacaine 2–2.5 mg and fentanyl 20–25 µg. Analgesia was then maintained with a continuous infusion of 1–2 mL/h of 0.125% bupivacaine and fentanyl 2 µg/mL. If the patient requested additional analgesia, 1–2 mL of the same mixture was administered as a bolus by the anesthesiologist. In the epidural group, continuous epidural analgesia was achieved with an initial bolus of 0.125% bupivacaine with 2 µg/mL fentanyl 10–15 mL, and maintained with infusion of the same mixture at 6 mL/h along with a patient controlled epidural analgesia (PCEA) bolus option. In both groups, the catheter remained in situ for the entire duration of labor, and was typically removed 30–60 min after delivery.

Statistical analysis

The primary outcome was the proportion of patients with prolonged second stage of labor while adjusting for age and parity. Prolonged second stage of labor was defined according to the American College of Obstetricians and Gynecologists criteria for laboring women with neuraxial analgesia (>2 h for multiparous women; >3 h for nulliparous women).^{10,11} If the parturient underwent cesarean delivery before the second stage of labor, the variable prolonged second stage of labor was neither defined as “yes” or “no”. As an additional outcome, we assessed the proportion of cesarean deliveries in each group. Secondary outcomes were complications related to anesthetic care: (1) the proportion of cases resulting in PDPH; (2) the incidence of failed labor analgesia resulting in the need for catheter replacement; and (3) the proportion of PDPH among all IDP cases, classified according to the mode of delivery (vaginal vs. cesarean delivery). For this last element, we adjusted for the type of neuraxial catheter (intrathecal vs. epidural), age and BMI, and the presence or absence of failed labor analgesia resulting in the need for catheter replacement before delivery.

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